

NOTES ON GEOGRAPHIC DISTRIBUTION

Insecta, Hemiptera, Reduviidae, *Panstrongylus geniculatus*: Geographic distribution map.

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Abstract

Panstrongylus geniculatus is one of the most widely distributed species of Triatominae in South and Central America, occurring in several biomes with different climatic characteristics. We present the results of captures of *P. geniculatus* provided from a 10-year program of entomological surveillance in the state of Espírito Santo, Brazil. We also present an updated geographic distribution map of *P. geniculatus* obtained from an extensive literature review. The entomological surveillance program, between 1996 and 2005, provided 110 capture registers of *P. geniculatus* in Espírito Santo. These are the first records of *P. geniculatus* from 15 municipalities in this state. *P. geniculatus* extends through 18 countries in Central and South America, from southern Mexico to northern Argentina.

Introduction

Triatomines (Hemiptera, Reduviidae, Triatominae) are strictly hematophagous insects that are widespread in several natural and artificial ecotopes (Schofield 2000), mainly on the American continent (Galvão et al. 2003). Several species of triatomines are vectors of Chagas disease, an endemic anthroponotic disease that affects 15 million individuals in Latin America, with at least 90 million people at risk of infection (WHO 2002). The etiologic agent of this parasitosis is *Trypanosoma cruzi*, a flagellate protozoan that circulates in sylvatic cycles, and, more recently, in domestic cycles involving humans (Guhl et al. 2000). More than 150 wild and domestic mammals serve as reservoir hosts of *T. cruzi* (Gaunt and Miles 2000).

Panstrongylus geniculatus is one of the most widely distributed species of Triatominae in South and Central America, occurring in several biomes with different climatic characteristics (Silveira et al. 1984; Carcavallo et al. 1999). It is associated with animal burrows in humid forests, especially with armadillos, which are reservoirs of *T. cruzi* (Lent and Wygodzinsky 1979). Although it occasionally invades houses, this triatomine has not adapted to colonize human domiciles, an important factor in limiting the potential of this species as a vector of Chagas disease to man (Jaramillo et al. 2002). Colonization of pigsties near to and contiguous with human domiciles in the Amazon River floodplain, however, has been reported, with related invasions of houses and attacks on residents (Valente et al. 1998; Valente 1999).

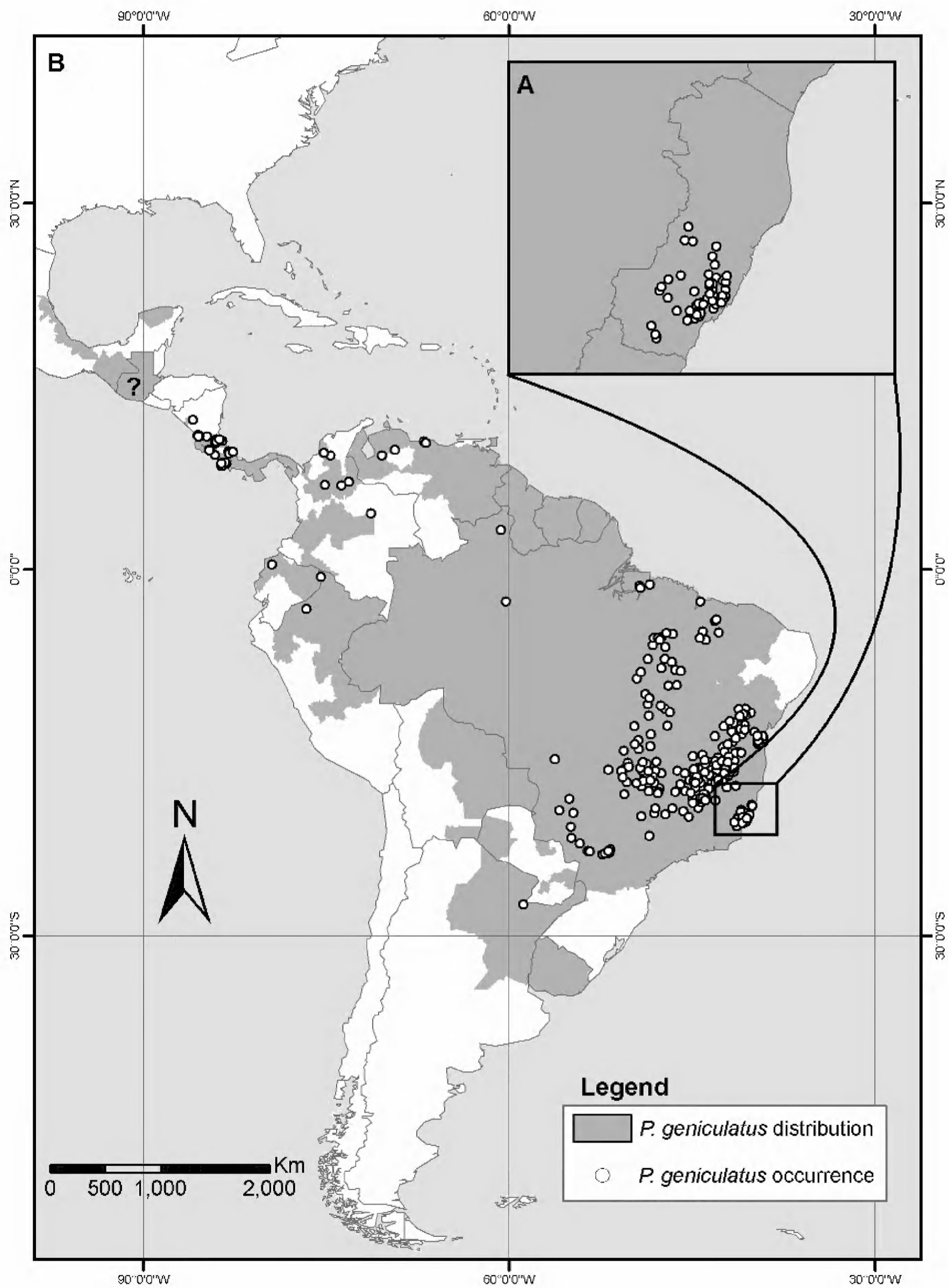
We present the results of captures of *P. geniculatus* provided from a 10-year program of entomological surveillance in the state of Espírito Santo, Brazil. We also present an updated geographic distribution map of this species obtained from an extensive literature review.

Material and methods

The study area comprises the Brazilian state of Espírito Santo, located in the southern Central Corridor of the Atlantic Forest, which has about 4.8 million ha. The annual mean temperature in the region is between 16-25 °C and the annual precipitation, between 900-2,100 mm. The elevation can reach 2,800 m in some sites (Hijmans et al. 2005). The area has a high level of species diversity, even after suffering intense devastation that reduced its original forest cover to about 5 % (Fonseca 1985).

We obtained the occurrence data of *P. geniculatus* from the database of the Fundação Nacional de Saúde of the state of Espírito Santo. This database originates from the entomological surveillance program, which is provided with records of triatomines that people have caught in their houses. We georeferenced the capture registers of *P. geniculatus* in study area between 1996 and 2005. We also created a geographic distribution map of *P. geniculatus* based on literature review.

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Figure 1 (page 148). (A) Occurrence points of *Panstrongylus geniculatus* in the Brazilian state of Espírito Santo, obtained from the database of the Fundação Nacional de Saúde, between 1996 and 2005. (B) Geographic distribution map of *P. geniculatus* based on literature review. The darker gray area represents the countries, states, departments or provinces where the species is known to occur. The points represent the localities or municipalities where the species was collected (this information was not always provided by the authors in their papers).

Results and discussion

The entomological surveillance program, between 1996 and 2005, provided 110 capture registers of *P. geniculatus* from 22 municipalities in the state of Espírito Santo. We are reporting here the first records of *P. geniculatus* from 15 municipalities of this state (Appendix 1). The distribution map is in Figure 1A.

The known range of *P. geniculatus* extends from southern Mexico to northern Argentina, including several of the Caribbean islands (Carcavallo et al. 1999). The 18 countries and their major administrative subdivisions (state, department or province) where the species occurs are shown on geographic distribution map (Figure 1B) and also listed here: ARGENTINA (Chaco, Corrientes, Entre Ríos, Formosa, Misiones, Santa Fe, Santiago Del Estero); BOLIVIA (Beni, Santa Cruz, Tarija); BRAZIL (Acre, Amapá, Amazonas, Bahia, Ceará, Distrito Federal, Espírito Santo, Goiás, Maranhão, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará, Paraná, Piauí, Rio de Janeiro, Rondônia, Roraima, São Paulo, Tocantins); COLOMBIA (Antioquia, Bolívar, Cauca, Cundinamarca, Huila, Meta, Norte de Santander, Putumayo, Santander, Sucre, Tolima, Valle del

Cauca); COSTA RICA (Alajuela, Guanacaste, Heredia, Limón, Puntarenas, San José); ECUADOR (Esmeraldas, Imbabura, Manabí, Napo, Orellana, Pastaza, Pichincha, Sucumbíos); FRENCH REPUBLIC (French Guiana); GUATEMALA?; GUYANA; MEXICO (Chiapas, Veracruz, Yucatán); NICARAGUA (Managua); PANAMA; PARAGUAY (Alto Paraná, Boquerón, Caaguazú, Concepción, Paraguari); PERU (Amazonas, Cajamarca, Junín, Loreto, Ucayali); SURINAME; TRINIDAD & TOBAGO (Trinidad); URUGUAY; VENEZUELA (Anzoátegui, Aragua, Barinas, Bolívar, Carabobo, Delta Amacuro, Distrito Capital, Falcón, Guárico, Lara, Mérida, Miranda, Monagas, Trujillo, Táchira, Yaracuy, Vargas, Zulia) (Lucena 1959; Silverie et al. 1964; Lent and Wygodzinsky 1979; D'Alessandro et al. 1984; Silveira et al. 1984; De Scorza et al. 1989; Omah-Maharaj 1989; Amunarriz et al. 1991; Bento et al. 1992; Cabello and Galindez 1998; Aguilar et al. 1999; Reyes-Lugo and Rodriguez-Acosta 2000; Zeledón et al. 2001; Crossa et al. 2002; Cuba et al. 2002; Marcilla et al. 2002; Galvão et al. 2003; Carrasco et al. 2005; Cortés and Suárez 2005; Luitgards-Moura et al. 2005; Sanchez-Martin et al. 2006).

Literature cited

- Aguilar, V. H., F. Abad-Franch, V. J. Racines, and C. A. Paucar. 1999. Epidemiology of Chagas disease in Ecuador. A brief review. *Memórias do Instituto Oswaldo Cruz* 94(1): 387-393.
- Amunarriz, M., M. E. Chico, and R. H. Guderian. 1991. Chagas disease in Ecuador: a sylvatic focus in the Amazon region. *The Journal of Tropical Medicine and Hygiene* 94(3): 145-149.
- Bento, D. N., L. M. Farias, M. F. Godoy, and J. F. Araujo. 1992. Epidemiologia da doença de Chagas na zona rural do município de Teresina-Piauí, Brasil. *Revista da Sociedade Brasileira de Medicina Tropical* 25(1): 51-58.
- Cabello, D. R. and I. Galindez. 1998. Vital statistics of *Panstrongylus geniculatus* (Latreille 1811) (Hemiptera: Reduviidae) under experimental conditions. *Memórias do Instituto Oswaldo Cruz* 93(2): 257-262.
- Carcavallo, R. U., S. I. Curto de Casas, I. A. Sherlock, I. G. Girón, J. Jurberg, C. Galvao, C. A. M. Segura, and F. Noireau. 1999. Geographical distribution and altitudinal dispersion, p. 747-792, In Carcavallo, R., I. G. Girón, J. Jurberg, and H. Lent (ed.). *Atlas of Chagas' Disease Vectors in the Americas*. III. Rio de Janeiro, Fiocruz.
- Carrasco, H. J., A. Torrellas, C. Garcia, M. Segovia, and M. D. Feliciangeli. 2005. Risk

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- of *Trypanosoma cruzi* I (Kinetoplastida: Trypanosomatidae) transmission by *Panstrongylus geniculatus* (Hemiptera: Reduviidae) in Caracas (Metropolitan District) and neighboring States, Venezuela. *International Journal for Parasitology* 35(13): 1379-1384.
- Cortés, L. A. and H. A. Suárez. 2005. Triatomines (Reduviidae: Triatominae) en un foco de enfermedad de Chagas en Talaigua Nuevo (Bolívar, Colombia). *Biomédica* 25: 568-574.
- Crossa, R. P., M. Hernández, M. N. Caraccio, V. Rose, S. A. S. Valente, V. C. Valente, J. M. Mejía, V. M. Ângulo, C. M. S. Ramírez, J. Roldán, F. Vargas, M. Wolff, and F. Panzera. 2002. Chromosomal evolution trends of the genus *Panstrongylus* (Hemiptera, Reduviidae), vectors of Chagas disease. *Infection, Genetics and Evolution* 2: 47-56.
- Cuba, C. A., F. Abad-Franch, J. Roldan Rodriguez, F. Vargas Vasquez, L. Pollack Velasquez, and M. A. Miles. 2002. The triatomines of northern Peru, with emphasis on the ecology and infection by trypanosomes of *Rhodnius ecuadoriensis* (Triatominae). *Memórias do Instituto Oswaldo Cruz* 97(2): 175-183.
- D'Alessandro, A., P. Barreto, N. Saravia, and M. Barreto. 1984. Epidemiology of *Trypanosoma cruzi* in the oriental plains of Colombia. *The American Journal of Tropical Medicine and Hygiene* 33(6): 1084-1095.
- De Scorza, C., S. Urdaneta-Morales, and L. Sampson-Ward. 1989. Urban *Trypanosoma (Schizotrypanum) cruzi*: pathology in white mice of isolates from *Panstrongylus geniculatus*. *Annales de la Société Belge de Médecine Tropicale* 69(4): 283-289.
- Fonseca, G. A. B. 1985. The vanishing Brazilian Atlantic forest. *Biological Conservation* 34(1): 17-34.
- Galvão, C., R. Carcavallo, D. S. Rocha, and J. Jurberg. 2003. A checklist of the current valid species of the subfamily Triatominae Jeannel, 1909 (Hemiptera, Reduviidae) and their geographical distribution, with nomenclatural and taxonomic notes. *Zootaxa* 202: 1-36.
- Gaunt, M. and M. Miles. 2000. The ecotopes and evolution of triatomine bugs (Triatominae) and their associated trypanosomes. *Memórias do Instituto Oswaldo Cruz* 95(4): 557-565.
- Guhl, F., C. Jaramillo, G. A. Vallejo, A. A. F. Cardenas, and A. Aufderheide. 2000. Chagas disease and human migration. *Memórias do Instituto Oswaldo Cruz* 95(4): 553-555.
- Hijmans, R. J., S. E. Cameron, J. L. Parra, P. G. Jones, and A. Jarvis. 2005. Very high resolution interpolated climate surfaces for global land areas. *International Journal of Climatology* 25: 1965-1978.
- Jaramillo, O. N., D. Castillo, and E. M. Wolff. 2002. Geometric morphometric differences between *Panstrongylus geniculatus* from field and laboratory. *Memórias do Instituto Oswaldo Cruz* 97(5): 667-673.
- Lent, H. and P. Wygodzinsky. 1979. Revision of the Triatominae (Hemiptera, Reduviidae) and their significance as vectors of Chagas' disease. *Bulletin of the American Museum of Natural History* 163: 127-516.
- Lucena, D. T. 1959. Ecologia dos triatomíneos do Brasil. *Revista Brasileira de Malariologia e Doenças Tropicais* 11: 577-635.
- Luitgards-Moura, J. F., J. Borges-Pereira, J. Costa, P. L. Zauza, and M. G. Rosa-Freitas. 2005. On the possibility of autochthonous Chagas disease in Roraima, Amazon region, Brazil, 2000-2001. *Revista do Instituto de Medicina Tropical de São Paulo* 47(1): 45-54.
- Marcilla, A., M. D. Barges, F. Abad-Franch, F. Panzera, R. U. Carcavallo, F. Noireau, C. Galvão, J. Jurberg, M. A. Miles, J. P. Dujardin, and S. Mas-Coma. 2002. Nuclear rDNA ITS-2 sequences reveal polyphyly of *Panstrongylus* species (Hemiptera: Reduviidae: Triatominae), vectors of *Trypanosoma cruzi*. *Infection, Genetics and Evolution* 1: 225-235.
- Omah-Maharaj, I. 1989. Strain identification of *Trypanosoma cruzi* isolated from *Panstrongylus geniculatus* in Trinidad, West Indies. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 83(2): 209.
- Reyes-Lugo, M. and A. Rodriguez-Acosta. 2000. Domiciliation of the sylvatic Chagas disease

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- vector *Panstrongylus geniculatus* Latreille, 1811 (Triatominae: Reduviidae) in Venezuela. Transactions of the Royal Society of Tropical Medicine and Hygiene 94(5): 508.
- Sanchez-Martin, M. J., M. D. Feliciangeli, D. Campbell-Lendrum, and C. R. Davies. 2006. Could the Chagas disease elimination programme in Venezuela be compromised by reinvasion of houses by sylvatic *Rhodnius prolixus* bug populations? Tropical Medicine and International Health 2(10): 1585-1593.
- Schofield, C. J. 2000. Biosystematics and evolution of the Triatominae. Caderno de Saúde Pública 16(1): 89-92.
- Silveira, A. C., V. R. Feitosa, and R. Borges. 1984. Distribuição de triatomíneos capturados no ambiente domiciliar, no período 1975/83, Brasil. Revista Brasileira de Malariologia e Doenças Tropicais 36: 15-312.
- Silverie, R., R. Kraemer, P. Fauran, and G. Chatenay. 1964. Epid'emiologie de la maladie de chagas en Guyane Française: infection naturelle de *Panstrongylus geniculatus*. Bulletin de la Société de Pathologie Exotique et de ses Filiales 57: 375-377.
- Valente, V. 1999. Potential for domestication of *Panstrongylus geniculatus* (Latreille, 1811) (Hemiptera, Reduviidae, Triatominae) in the municipality of Muaná, Marajó island, state of Pará, Brazil. Memórias do Instituto Oswaldo Cruz 94(1): 399-400.
- Valente, V. C., S. A. Valente, F. Noireau, H. J. Carrasco, and M. A. Miles. 1998. Chagas disease in the Amazon Basin: association of *Panstrongylus geniculatus* (Hemiptera: Reduviidae) with domestic pigs. Journal of Medical Entomology 35(2): 99-103.
- WHO. 2002. Control of Chagas disease: second report of the WHO Expert Committee. WHO Technical Report Series 905: 109p.
- Zeledón, R., J. A. Ugalde, and L. A. Paniagua. 2001. Entomological and ecological aspects of six sylvatic species of triatomines (Hemiptera, Reduviidae) from the collection of the National Biodiversity Institute of Costa Rica, Central America. Memórias do Instituto Oswaldo Cruz 96(6): 757-764.
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Appendix 1
Municipalities with records of *Panstrongylus geniculatus* in the state of Espírito Santo, Brazil.

Municipality	Latitude	Longitude	Reference
Alegre	-20.71849	-41.51256	Silveira et al.
Alfredo Chaves	-20.56306	-40.82642	This paper
Anchieta	-20.71863	-40.68430	Silveira et al.
Cariacica	-20.28931	-40.44518	Silveira et al.
Castelo	-20.55001	-41.20295	This paper
Conceição do Castelo	-20.36829	-41.26626	This paper
Domingos Martins	-20.30862	-40.84577	Silveira et al.
Guarapari	-20.58164	-40.54670	Silveira et al.
Iconha	-20.75473	-40.85736	Silveira et al.
Itaguaçu	-19.72701	-40.86461	This paper
Itarana	-19.94872	-40.88777	This paper
Jerônimo Monteiro	-20.81241	-41.39226	This paper
Laranja da Terra	-19.87469	-41.05610	This paper
Linhares	-19.38350	-40.02353	Silveira et al.
Mimoso do Sul	-21.08629	-41.37795	This paper
Muqui	-20.93605	-41.33943	This paper
Rio Novo do Sul	-20.81782	-40.91831	This paper
Santa Leopoldina	-20.12148	-40.54015	This paper
Santa Maria de Jetibá	-20.08528	-40.80452	This paper
Santa Teresa	-19.87702	-40.63280	This paper
Serra	-20.12730	-40.30131	Silveira et al.
Vargem Alta	-20.64593	-41.00307	This paper
Venda Nova do	-20.37107	-41.13904	This paper
Viana	-20.39770	-40.50686	Silveira et al.